



SPECIFICATION

For an

“Above Ground - DOUBLE FOLD SEAMED STORAGE TANK”

1.0 GENERAL

1.1 Scope of Work

1.1.1 Furnish and erect a “ Above Ground Carbon Steel” double seamed connected “Galvanized-Stainless steel” liquid storage tank, including foundation, tank structure and tank appurtenances as shown on the contract drawings and described herein. The tank shall be designed to store (Water or Wastewater).

1.1.2 All required labor, materials and equipment shall be included.

1.1.3 The exterior tank color shall be [choose one of the following].
_____ standard

1.2 Qualifications of Tank Supplier

1.2.1 The Engineers selection of the _____ tank construction for this facility has been predicated upon specific criteria, construction methods, and an optimum coating for resistance to internal and external tank corrosion. Deviations from the specified design, construction or coating details, will not be permitted.

1.2.2 The bidder shall offer a new tank structure as supplied from a manufacturer specializing in the design, fabrication and erection of a Double seam connected Carbon steel “galvanized” plate. This plate shall be lined with 316Ti Stainless steel plate that is applied in a controlled factory setting, then the completed rolls are shipped to the Job site for erection.

1.2.3 The tank shown on the contract drawings and specified herein is a model Lipp Storage Tank as manufactured by the Lipp America Tank Systems, LLC., in Muskegon Michigan.

1.2.4 Alternate _____ tank products, as provided by other manufacturers, will be considered for prior approval by the Engineer.

- 1.2.5 Strict adherence to the standards of design; fabrication; erection; product quality; and long term performance, established in this specification will be required by the Owner and Engineer.
- 1.2.6 Tank suppliers wishing to pre-qualify shall submit the following to the Engineer/Owner for consideration:
 - 1.2.6.1 Typical structure and foundation drawing(s).
 - 1.2.6.2 List of tank materials, appurtenances and tank coating specifications.
- 1.2.7 Only bids from tank suppliers who have successfully pre-qualified will be considered.
- 1.2.8 The Engineer reserves the right to evaluate all bids based on long term, 30 year minimum operation, tank sidewall and interior coatings and maintenance costs. Values to be used in this evaluation will be at the discretion of the Engineer, as detailed in this specification and bid tabulation form. The Engineer will add such costs, dependent upon the type of tank offered, to the bidder's price to determine the effective low bid for purposes of making the award.

1.3 Qualifications of Tank Builder

- 1.3.1 The tank builder shall be a company in good standing with the Local State where tank is to be constructed and shall comply with all applicable OSHA, EEO and all statutes.
- 1.3.2 The tank builder shall be experienced in the construction of the specified tank and shall be certified by the manufacturer as an authorized builder and shall use the Double Fold assembly machine in order to conduct plate seam folding to assemble the tank sidewall as designed. The builder shall have built at least five (5) tanks of similar type that are equal or greater in size than the specified tank.
- 1.3.3 Building crews shall comply with the tank manufacturer's requirements for building practices and equipment used on the job. The crew personnel shall be trained in a factory sponsored program and shall be certified by the tank manufacturer as having satisfactorily completed that program.
- 1.3.4 The builder will be required at all times to observe and comply with the provisions State Statutes, relating to the regulation of laborers, mechanics and other workers employed in any public works by the State, County, City or any political subdivision or by anyone under Contract for public works. The builder shall comply with the Department of Labor prevailing wage rates for the County where the project is being performed

1.4 Submittal Drawings and Specifications

- 1.4.1 The Tank Manufacturing, Construction and assembly, shall be governed by the Tank suppliers & the Owners drawings and specifications showing general

dimensions and construction details after written approval by the Engineer of detailed erection drawings prepared by the tank bidder. There shall be no deviation from the drawings and specifications, except upon written order from the Engineer.

1.4.2 The bidder is required to furnish, for the approval of the Engineer and at no increase in contract price, _____ sets of complete specifications and construction drawings for all work not shown in complete detail on the bidding drawings. A complete set of structural calculations shall be provided for the tank structure and foundation. All such submissions shall be stamped by a Licensed Professional Engineer licensed in the state of project location, as well as by a Licensed Professional Engineer or Structural Engineer employed on the tank manufacturer's engineering staff. Where the tank manufacturer's P.E. is licensed in the state of the project location, only one stamp is required.

1.4.3 The tank manufacturer and installing contractor's standard published warranty shall be included with submittal information.

1.4.4 The tank manufacturer shall include a standard Operation and Maintenance Manual upon receipt of approved drawings.

2.0 DESIGN CRITERIA

2.1 Tank Size

2.1.1 The specialized Double seam galvanized & stainless steel lined tank shall have a nominal diameter of _____ feet, with a nominal sidewall height (to roof eave) of _____ feet. The base tank exterior color shall be the un-coated Galvanized steel plate. The tank exterior may be coated as per Colors selected by owner or engineer.

2.2 Tank Capacity

2.2.1 Tank capacity shall be _____ gallons (nominal, U.S. gallons) with a freeboard of 1' 0".

2.3 Floor Elevation

2.3.1 Finished floor elevation shall be set at Elev. _____

2.4 Tank Design Standards

2.4.1 The materials, design, fabrication and erection of the **Double seam folded connection system** shall conform to the General Technical Approvals No. Z-14. 3-15 and to the scope of the standard DIN EN 1993 – 4-1:2010-12. The Conditions described in DIN EN 1993 – 4-1:2010-12, shall be applied to Tanks used for Liquid storage of Non-hazardous materials. The general approval herein deals exclusively with the Double seam as a mechanical connection of the Circular

wrapped steel sheeting. The structural design of the Double seam connection tank system shall conform to the general principals of AWWA Standard Latest revision.

2.5 Design Loads

2.5.1 Specific Gravity 1.0

2.5.2 Wind Velocity 100 mph

2.5.3 Allowable Soil Bearing Loading ____ psf (Per Eng.'s Soils Report)

2.5.4 Roof Snow Load ____ psf

2.5.6 Earthquake Seismic Design

PseudoDynamic Site Amplification Factor, S 1.5

Use Factor, I, 1.25

3.0 MATERIALS SPECIFICATIONS

3.1 Plates and Sheets

3.1.1 Plates and sheets used in the construction of the double seam tank shell, shall comply with the minimum standards of AISC, & ASTM, latest edition.

3.1.2 Design requirements for steel sheet shall be ASTM Type A Grade 50 with a maximum allowable tensile stress of 40,000 psi.

3.1.3 Design requirements for all galvanized steel sheeting shall be for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. As required by standard ASTM A653.

3.2 Sealants

3.2.1 The double seam folded plate systems shall have a joint sealant applied, and shall be a one component, moisture cured, polyurethane compound. The sealant shall be suitable for contact with the liquid contents of the tank and shall be certified to meet the ANSI/NSF Standard 61 for indirect additives. The sealant shall be a Sika 1A sealant material or equal.

3.2.2 The sealant shall be used to seal between the double seam folded plate connections. The sealant shall cure to a rubber-like consistency, have excellent adhesion to the steel plate, low shrinkage, and be suitable for interior and exterior use.

3.2.3 Sealant curing rate at 73°F and 50% RH

3.5.3.1 Tack-free time: 6 to 8 hours.

3.5.3.2 Final cure time: 10 to 12 days.

3.2.4 Neoprene gaskets and tape type sealer shall not be used.

4.0. Tank interior Linings and coatings

4.1.0 Stainless Steel Interior Lining “Verinox” is completed in a factory machining process as follows:

4.1.1 All steel sheets shall be provided in a rolled coil and run through a special adhesive compressive process in which the Stainless steel interior Liner layer is adhered to the base carbon steel plate by way of the use of a rolling machine in which an isolation layer of PVC is rolled and compressed thus the interior layer is bonded to form a protective liner against corrosion.

4.1.2 Once all coils are lined with the stainless steel then all finished coils of steel are wrapped in protective packaging for shipment to the site.

4.1.3 Inspection of all steel sheets shall be made for traces of foreign matter or rust. If foreign material, damage or rust is found then all sheets shall be rejected and will not be allowed to be lined with the stainless steel inner layer.

4.2 Factory Inspection

4.2.1 The manufacture’s quality system shall be ISO 9001 certified.

4.2.2 All steel coils shall be inspected for mil thickness and galvanized quality.

4.3 Packaging

4.3.1 All sheets that pass Factory Inspection and Quality Control checks shall be protected from damage prior to packing for shipment.

4.3.2 Heavy plastic sheeting shall be placed around all coils to eliminate any abrasion or damage during shipment.

5.0 TANK ASSEMBLY

5.1 Foundation-

5.1.1 The tank foundation shall be a part of the design contract and shall be installed by the tank bidder, unless otherwise noted.

5.1.2 The tank foundation shall be designed by the Tank manufacturer to safely sustain the structure and its live loads.

5.1.3 Tank footing design shall be based on the soil bearing capacity given in section 2.5.3 as determined by geotechnical analysis performed by a licensed soils engineer. The cost of this investigation and analysis is not to be included in the bid price. Copies of the soil report are to be provided to the bidder prior to bid date by the Owner or Engineer.

5.1.4 Footing designs for soil bearing strengths less than that specified, and from designs deviating from tank manufacturers standard shall be the responsibility of the

Owner and his Engineer based on tank live and dead loading data provided by the tank manufacturer.

5.2 Concrete Floors

- 5.2.1 The floor design is to be of reinforced concrete with a formed trough allowing for the steel sidewall sheet to be embedded into the trough setting on level plates equally placed in the trough as per the Tank “Double seam” manufacturers required design. The Steel sidewall of the double seam tank shall be welded to each level plate around the circumference of the entire tank base ring area.
- 5.2.2 The placement and leveling of the attachment plates shall be required and the maximum differential elevation within the trough shall not exceed one-sixteenth (1/16) inch within any ten (10) feet of length.
- 5.2.3 Once the Sidewall ring is lowered into the trough and welded in place, then each weld shall be inspected as to its consistency and penetration for strength.
- 5.2.4 The Embedment trough is to be filled with a quick cure concrete gout material, so as to provide a complete water tight seal between the steel sheeting and concrete floor.
- 5.2.5 To provide a complete water sealant around the inside and outside edge of the slot mount embedment a PVC sealant is to be placed a minimum of 4inch up the tank wall and 4 inches out on the concrete floor.

5.3 Sidewall Structure

- 5.3.1 Field assembly of the double seam folded Steel tank shall be in strict accordance with the procedures outlined in the manufacturers assembly manual, and performed by an authorized Double seam tank supervisor using the specialty erection assembly machines regularly required for all assembly of the double seam tanks, also all assistance on site shall be factory trained and certified erectors.
- 5.3.2 Specialized erection machines and building frames and equipment developed and manufactured by the tank manufacturer shall be used to erect the tanks.
- 5.3.3 Particular care shall be taken in handling of the tank coils and assembly crew shall avoid abrasion or damage of the steel coil. Prior to a liquid test, all surface areas shall be visually inspected by the Engineer.
- 5.3.4 The placement of sealant into the double fold systems may be inspected as the erection process is completed. However, the Engineers inspection shall not relieve the bidder from his responsibility for liquid tightness.
- 5.3.5 No backfill shall be placed against the tank sidewall without prior written approval and design review of the tank manufacturer. Any backfill shall be placed according to the strict instructions of the tank manufacturer.

6.0 Dome Roof assembly

- 6.1 The roof shall be constructed of non-corrugated triangular aluminum panels which are sealed and firmly clamped in an interlocking manner to a fully triangulated aluminum space truss system of wide flange extrusions, thus forming a dome structure.
 - 6.1.1 The roof shall be a dome structure conforming to AWWA . The dome shall conform to the dimensions of the tank using a fully triangulated space truss and non-corrugated closure panels. It shall be clear-span and designed to be self-supporting from the periphery structure with primary horizontal thrust contained by an integral tension ring. Provision shall be made in the design for thermal expansion of all dome parts over a temperature range of -40°F to +140°F. The dome dead weight shall not exceed 3.5 pounds per square foot of surface area.
 - 6.1.2 The dome surface paneling shall be designed as a watertight system under all design load and temperature conditions. All raw edges of the aluminum panels shall be covered, sealed, and firmly clamped with batten bars in an interlocking manner to prevent slipping or disengagement under design load and temperature changes.
 - 6.1.3 The roof framing system shall be designed as a three dimensional truss with moment-resisting joints. The design must consider the increased minor axis bending and compression induced in the framing members due to tension in the roof panels.
 - 6.1.4 The manufacturer shall furnish a roof opening which shall be placed near the outside tank ladder and which shall be provided with a hinged cover and a hasp for locking. The opening shall have a clear dimension of at least thirty (30") inches in one direction and thirty (30") inches in the other direction. The opening shall have a curb at least four (4") inches in height, and the cover shall have a downward overlap of at least two (2") inches, or a gasket weather-tight cover in lieu of the four (4") inch curb and two (2") inch overlap.
- 6.2 The dome and tank shall be designed to act as an integral unit. The tank shall be designed to support an aluminum dome roof including all specified live loads.
 - 6.2.1 The structural analysis shall be performed using stiffness analysis models. The structural computer models shall include the effect of geometry irregularities such as dormer openings and perimeter support members.
 - 6.2.2 Connection forces shall be transferred through gusset plates connected to the top and bottom flanges of the beam-struts. The connections shall be designed as moment connections; a minimum of four bolts shall be used to connect the gusset plate to each strut flange.
 - 6.2.3 All dome aluminum fasteners shall be designed with a safety factor of 2.34 on ultimate strength and 1.65 on yield strength.
 - 6.2.4 The design of welded components shall be in accordance with the Aluminum Structural Welding Code ANSI/AWS D1.1/D1.2.
 - 6.2.5 The vertical loads transferred from the roof to the tank shall be in-line with the tank wall. The transfer of horizontal loads to the tank shall be minimized by means of low friction slide supports. Radial forces applied to the tank shall not exceed 10% of the vertical reactions.

6.2.6 Dissimilar materials which are not compatible shall be isolated by an insulator to prevent galvanic corrosion. Passivated 300 series Stainless Steel is compatible to Aluminum.

6.3 Materials:

6.3.1 Triangulated dome frame struts: AA6005A-T6 or AA6001-T6 aluminum.

6.3.2 Structural frame gussets: 0.375" nominal thickness AA6061-T6 aluminum.

6.3.3 Triangular closure panels: .050' AA3003-H16 aluminum sheet.

6.3.4 Triangular skylight panels: 0.25" nominal thickness clear acrylic.

6.3.5 Perimeter tension/compression ring: 6061-T6 or AA6005A-T6 aluminum.

6.3.6 Fasteners: AA2024-T4 anodized aluminum or series 300 stainless steel.

6.3.7 Sealant: Silicone, conforming to Federal Specification TT-S-00230 or equal.

6.3.8 Gaskets: Silicone, conforming to Federal Specification ZZ-R-765, class 2, grade 50 or equal.

6.3.9 Anchor Bolts: austenitic series 300 stainless steel.

6.3.10 Dormers, doors, vents and hatches: AA6061-T6, AA6005A-T6, AA5086-H34 or AA5052-H36 or AA 5052-H32 aluminum, 0.90" nominal thickness.

6.4 Roof Vent

6.4.1 A properly sized vent assembly in accordance with AWWA D103 shall be furnished and installed above the maximum liquid level of sufficient capacity so that at maximum design rate of fill or withdrawal, the resulting interior pressure or vacuum will not exceed 0.5" water column.

6.4.2 The overflow pipe shall not be considered to be a tank vent.

6.4.3 The vent shall be constructed of aluminum such that the hood can be unbolted and used as a secondary roof access.

6.4.4 The vent shall be so designed in construction as to prevent the entrance of birds and/or animals by including an expanded aluminum screen (1/2 inch) opening. An insect screen shall be provided.

7.0 Appurtenances (per AWWA D103, Section 5)

7.1 Pipe Connections

7.1.1 Where pipe connections are shown to pass through tank panels, they shall be field located, saw cut, (acetylene torch cutting or welding is not permitted), and utilize an interior and exterior flange assembly and the tank shell reinforcing shall comply with AWWA D103 latest edition. Sika 1A sealant or equal shall be applied on any cut panel edges or bolt connections.

7.1.2 Overflow piping shall be ___ inches diameter schedule 80 PVC, seamless aluminum tubing, or FRP.

7.2 Outside Tank Ladder

- 7.2.1 An outside tank ladder shall be furnished and installed as shown on the contract drawings.
- 7.2.2 Ladders shall be fabricated of aluminum and utilize grooved, skid-resistant rungs.
- 7.2.3 Safety cage and step-off platforms shall be fabricated of galvanized steel. Ladders shall be equipped with a hinged lockable entry device.

7.3 Access Door

- 7.3.1 One bottom access door shall be provided as shown on the contract drawings in accordance with AWWA D100 and D103.
- 7.3.2 The manhole opening shall be a minimum of 30 inches in diameter. The access door (shell manhole) and the tank shell reinforcing shall comply with AWWA D103 latest edition, and AWWA D100.

7.4 Identification Plate

- 7.4.1 A manufacturer's nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior sidewall at a location approximately five (5) feet from grade elevation in a position of unobstructed view.

8.0 FIELD TESTING

8.1 Hydrostatic

- 8.1.1 Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling tank to its overflow elevation.
- 8.1.2 Any leaks disclosed by this test shall be corrected by the erector in accordance with the manufacturer's recommendations.
- 8.1.3 Water required for testing shall be furnished by the owner at the time of tank erection completion, and at no charge to the tank erector. Disposal of test water shall be the responsibility of the owner.
- 8.1.4 Labor and equipment necessary for tank testing is to be included in the price of the tank.

9.0 TANK MANUFACTURER'S WARRANTY

- 9.1 The tank manufacturer shall include a warranty for the tank materials and any required repair of the Interior linings. The tank manufacturer shall warrant the liquid storage tank shall be free from any defect in material or workmanship under normal and proper use, maintenance and operation, during the period expiring on the earlier of (i) one year after liquid is first introduced into the tank or (ii) 14 months after a substantial portion of the tank sheets is delivered to the site where the tank is erected. The tank manufacturer shall warrant the interior lining of Stainless steel of the liquid storage tank will not corrode, under normal and proper use, maintenance and operation.

9.2 The tank manufacturer shall warrant the Interior stainless steel layer of the tank will not corrode, under normal and proper use, maintenance and operation, during the period expiring on the earlier of (5) five years after liquid is first introduced into the tank or (ii) 62 months after a substantial portion of the tank sheets is delivered to the site where the tank is erected.